Planning of inserted /ɻ/ in the speech of Australian English-speaking children
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To become fluent speakers, children need to learn various connected speech processes when they combine words to form utterances. An important connected speech process in non-rhotic Australian English (AusE) is /ɻ/ insertion (Cox et al., 2014). Word pairs like ‘sore/saw’ are CV homophones in citation form, but in connected speech their realisation may change when followed by a word beginning with a vowel. For example, in phrases like ‘sore arm’ / ‘saw arm’, /ɻ/ may be inserted after the first vowel (e.g. /u:ɹəm/) to break up the dispreferred V₁V₂ sequence across a syllable boundary (i.e. hiatus) for sonority reasons (Bell and Hopper, 1978). The /ɻ/ inserted after ‘sore’ is referred to as the linking ‘ɻ’ (i.e., present in the orthography), and the other as the intrusive ‘ɹ’. Several studies have found more /ɻ/ insertion for linking compared to intrusive contexts, presumably based on orthographically motivated resistance against the latter (English RP: Hannisdal 2006; Mompeán and án-Guillámon, 2009; New Zealand English: Hay and Maclagan, 2012). In adults, /ɻ/ insertion typically occurs within a phonological phrase when a non-high vowel (e.g. /o/) is followed by an unstressed/reduced vowel (Cox et al., 2014). While both linking and intrusive inserted /ɻ/ have been studied in adult speech (Mompeán and án-Guillámon, 2009; Hay and Maclagan, 2012; Cox, et al., 2014), little is known about /ɻ/ insertion in children’s speech apart from a few inconsistent reports on young children’s use of liaison consonants in British English (Newton and Wells, 1999, 2002; Thompson and Howard, 2007). Since there have been no carefully controlled studies of /ɻ/ insertion for English speaking children, the extent to which children are sensitive to the dispreferred hiatus context is unknown. If children are found to be sensitive to hiatus, it is not clear whether the insertion type (i.e. linking vs. intrusive) will influence their inserted /ɻ/ usage and whether it is a planned ahead when used. Whalen (1990) suggests that planning of articulatory gestures occurs when speakers know upcoming phonemes in advance. He found that anticipatory co-articulation between vowels emerged in nonsense V₁CV₂ strings when V₂ was known in advance of the speaker’s production, but disappeared when V₂ was concealed. This indicates that anticipatory co-articulation is planned when the phonemic composition of the larger word/phrase is known. If /ɻ/ is planned as part of a larger unit, we should expect to see anticipatory co-articulation from the beginning of V₁. As one of the main acoustic characteristic of /ɻ/ is a low F3 minimum (Espy-Wilson et al., 2000), anticipatory co-articulation should contribute to a lowered F3 towards the beginning of V₁.

The goal of this study was therefore to 1) determine the degree to which AusE-speaking 6-year-olds use /ɻ/ insertion, 2) whether the type of insertion context (linking or intrusive) matters, and 3) if /ɻ/ is planned together with V₁ as part of a larger unit. On the basis of Newton and Wells (1999, 2002), we predicted that children would use /ɻ/insertion to break up the V₁V₂ hiatus. We predicted no difference in use of /ɻ/ insertion between linking and intrusive contexts because young children have limited exposure/experience to orthography. Given Whalen (1990), we also expected to find anticipatory co-articulation between /ɻ/ and V₁, suggesting that inserted /ɻ/ is planned ahead.

Participants were 13 monolingual AusE-speaking children 6-year-olds (7F, 6M, mean age = 6:1 years). An additional 19 children were excluded due to exposure to other rhotic languages/dialects (n=13), incorrect use of prosody (n=4), dysfluency (n=1) or use of labio-dental approximant instead of [ɻ] (n=1). All were invited to participate in an elicited production experiment, generating sentences via a picture-naming task presented through a series of three-slice sequences (e.g. 1. ‘This is the paw’; 2. ‘This is the cat’; 3. ‘This is the paw of the cat’). The first item in this set containing a pre-pausal vowel was used as the control. Four key test words were used: ‘door/floor’ (linking) and ‘paw/claw’ (intrusive). These key words were combined with ‘of’ and a set of 3 associated nouns (e.g. car, barn, cat, crab) to generate 6 key test sentences in two experimental blocks (intrusive and linking) (e.g. ‘This is the door of the barn’). Three practice items were used for familiarisation. All responses were audio-recorded. An AusE-speaking phonetician perceptually coded the data for presence vs. absence of inserted /ɻ/. F3 values were then extracted at ten equidistant time points across the /V₁ɻV₂/ (‘door’, ‘paw’) and the /V₁ɻV₂/ (‘floor’, ‘claw’) interval to track the F3 trajectory.

Perceptual analysis revealed that 55% of items contained inserted /ɻ/ and there was no significant difference in the incidence of /ɻ/ insertion between the linking and intrusive contexts suggesting that the status of inserted /ɻ/ for these young children is the same across all items. Of the 13 participants 5 produced no inserted /ɻ/ while the remaining 8 children produced at least 8/12 tokens of inserted /ɻ/ (Figure 1.). Thus some children use inserted /ɻ/ but others do not, raising questions about whether this is a sociophonetic or developmental effect.
The acoustic analysis then focused on the subset of 8 children who produced /ɹ/. Items were tallied across both linking and intrusive contexts. A significant effect of anticipatory co-articulation was found for both /V_1V_2ɹ/ (t (7) = -4.101, p = .005) and /V_1V_2V_3ɹ/ (t (7) = -5.301, p = .001) intervals. Relative to the onset of the control V_1, F3 at the onset of V_1 in the test items was lower when /ɹ/ was inserted (as illustrated in Figure 2 from the /V_1ɹV_2/ context). Together these findings show that some 6-year-old AusE-speaking children use /ɹ/ insertion as a strategy to resolve the dispreferred hiatus context in connected speech. Importantly, they plan /ɹ/ together with V_1 as part of a larger unit (i.e. beyond a phoneme), suggesting that /ɹ/ must be known in advance during phonological encoding, comparable to findings in a similar study of AusE-speaking adults.

![FIGURE 1: Number of ‘r’ insertions per child in linking and intrusive contexts.](image1)

![FIGURE 2: (a) Children’s formant trajectories from the control vowel /o:/ in phrase final ‘paw’ and ‘door’ (no F3 lowering), versus (b) the formant trajectories from the V_1ɹV_2 /o:ɹa/ interval (with F3 lowering), with +/- 1 standard error.](image2)

References


